

In the Claims

Please replace all prior versions, and listings, of claims in the application with the following listing of claims, including marked-up claims with insertions indicated by underlining and deletions indicated by strikeouts and/or double bracketing:

Listing of Claims

1. (Currently Amended) A digital subscriber line transmission system comprising:
an inverse fast Fourier transform circuit generating successive outgoing time domain symbols without cyclic suffixes on a subscriber line from respective groups of digital frequency domain coefficients;
a fast Fourier transform circuit generating groups of digital frequency domain coefficients from respective incoming time domain symbols received on the subscriber line, a current incoming symbol being delayed with respect to a current outgoing symbol by a predetermined time interval; and
a processing circuit for making sub-carriers of a local echo of the outgoing time domain symbols orthogonal to sub-carriers of the incoming time domain symbols, said processing circuit comprising means for adding to said incoming time domain symbols an estimated echo obtained by filtering the difference between a signal portion following the end of the current outgoing symbol and a beginning portion of the current outgoing symbol, wherein said portions have a duration at least equal to said predetermined time interval.
2. (Original) The system of claim 1, wherein the filter is a finite impulse response filter having a size adapted for processing samples of the symbols only during said predetermined time interval, comprising means for continuously calculating filter coefficients from the signals received and transmitted on the subscriber line.
3. (Original) The system of claim 1, wherein the predetermined time interval is equal to a maximum delay between the incoming and outgoing symbols.

4. (Previously Presented) The system of claim 1, further comprising:
a FIFO memory receiving the outgoing symbols;
a subtractor arranged for subtracting the outgoing symbols from the output of the FIFO memory;

said filter receiving the output of the subtractor and enabled only during said predetermined time interval from the end of each outgoing symbol; and
an adder receiving the output of the filter and said incoming symbols.

5. (Previously Presented) The system of claim 4, wherein the FIFO memory has a size for storing only the beginning portion of each outgoing symbol, is write-enabled during said predetermined time interval from the beginning of each outgoing symbol, and read-enabled during said predetermined time interval from the end of each outgoing symbol.

6. (Currently Amended) In a digital subscriber line (DSL) transmission system in which at least a first outgoing symbol and a second outgoing symbol are successively transmitted, at least one incoming symbol is received, and an echoed echo of the first outgoing symbol and an echoed echo of the second outgoing signal symbol are successively received as part of an echo signal, a method comprising an act of:

~~A) compensating at least a first portion of the echoed second outgoing signal based on an estimation of a first portion of the echoed first outgoing symbol;~~

~~wherein the act A) includes an act of:~~

(A) making sub-carriers of the echo signal orthogonal to sub-carriers of the at least one incoming symbol by replacing the a first portion of the echoed echo of the second outgoing signal symbol with the an estimation of the a first portion of the echoed echo of the first outgoing symbol; and

~~making the echoed first outgoing symbol and the echoed second outgoing signal orthogonal to the first outgoing symbol and the second outgoing symbol.~~

7. (Canceled)

8. (Canceled)

9. (Currently Amended) The method of claim 6 wherein the first portion of the ~~echo~~echo of the second outgoing signal and the first portion of the ~~echo~~echo of the first outgoing symbol have a same length that is less than or equal to a maximum delay between transmitted and received symbols.

10. (Currently Amended) The method of claim 9 wherein:
each of the first outgoing symbol and the second outgoing symbol ~~has~~ have a same total length; and
the length of the first portion of the ~~echo~~echo of the second outgoing ~~signalsymbol~~ and the first portion of the ~~echo~~echo of the first outgoing symbol does not exceed 5% of the total length.

11. (Currently Amended) The method of claim 6 wherein the act A) comprises acts of:
A1) obtaining a difference between a first portion of the first outgoing symbol and a first portion of the second outgoing symbol;
A2) applying an estimated transfer function of echo generation to the difference to generate an echo compensation signal; and
A3) adding the echo compensation signal to at least the first portion of the ~~echo~~echo of the second outgoing symbol.

12. (Previously Presented) The method of claim 11, wherein the act A1) includes an act of:
applying a one symbol delay to at least the first and second outgoing symbols.

13. (Previously Presented) The method of claim 12, wherein the act A2) includes an act of:

passing the difference through a finite impulse response filter having the estimated transfer function of the echo generation.

14. (Previously Presented) The method of claim 12, wherein the act A2) includes an act of:

calculating the estimated transfer function based at least on a plurality of outgoing symbols and a plurality of incoming symbols.

15. (Previously Presented) The method of claim 14, wherein each outgoing symbol and each incoming symbol has a total symbol length, and wherein the act of calculating the estimated transfer function includes an act of:

calculating the estimated transfer function based only on a portion of the total symbol length.

16. (Previously Presented) The method of claim 15, wherein the act of calculating the estimated transfer function includes an act of calculating the estimated transfer function based on approximately 5% of a total number of samples of each symbol.

17. (Currently Amended) In a digital subscriber line (DSL) transmission system in which at least a first outgoing symbol and a second outgoing symbol are successively transmitted, at least one incoming symbol is received, and an ~~echoed~~echo of the first outgoing symbol and an ~~echoed~~echo of the second outgoing signal are successively received as part of an echo signal, an apparatus [[,]] comprising:

~~—— at least one controller configured to compensate at least a first portion of the echoed second outgoing signal based on an estimation of a first portion of the echoed first outgoing symbol; and~~

~~wherein the at least one controller further is configured a circuit to make sub-carriers of the echo signal orthogonal to sub-carriers of the at least one incoming symbol, the circuit operative to replace the first portion of the echo of the echoed second outgoing signal symbol with the an estimation of the first portion of the echo of the ~~echoed~~ first outgoing symbol[[:]]~~
~~wherein each of the first and second outgoing symbols includes a cyclic prefix; and~~
~~further comprising a circuit for making the ~~echoed~~ first outgoing symbol and the ~~echoed~~ second outgoing signal orthogonal to the first outgoing symbol and the second outgoing symbol.~~

18. (Canceled)

19. (Canceled)

20. (Currently Amended) The apparatus of claim 17, wherein the first portion of the echo of the ~~echoed~~ second outgoing signal and the first portion of the echo of the ~~echoed~~ first outgoing symbol have a same length that is less than or equal to a maximum delay between transmitted and received symbols.

21. (Currently Amended) The apparatus of claim 20, wherein:
~~each of the first outgoing symbol and the second outgoing symbol has~~have a same total length; and
the length of the first portion of the echo of the ~~echoed~~ second outgoing signal and the first portion of the echo of the ~~echoed~~ first outgoing symbol does not exceed 5% of the total length.

22. (Currently Amended) The apparatus of claim 17, wherein the ~~at least one controller further~~ circuit is configured to:

obtain a difference between a first portion of the first outgoing symbol and a first portion of the second outgoing symbol;

apply an estimated transfer function of echo generation to the difference to generate an echo compensation signal; and

add the echo compensation signal to at least the first portion of the echo of the echoed second outgoing symbol.

23. (Currently Amended) The apparatus of claim 22, wherein the ~~at least one controller further~~ circuit includes at least one delay unit configured to apply a one symbol delay to at least the first and second outgoing symbols.

24. (Currently Amended) The apparatus of claim 23, wherein the ~~at least one controller further~~ circuit further includes a finite impulse response filter, coupled to the at least one delay unit and having the estimated transfer function of the echo generation, to process the difference.

25. (Currently Amended) The apparatus of claim 24, wherein the ~~at least one controller further~~ circuit further includes at least one calculating unit configured to calculate the estimated transfer function based at least on a plurality of outgoing symbols and a plurality of incoming symbols.

26. (Previously Presented) The apparatus of claim 25, wherein each outgoing symbol and each incoming symbol has a total symbol length, and wherein the at least one calculating unit is configured to calculate the estimated transfer function based only on a portion of the total symbol length.

27. (Previously Presented) The apparatus of claim 26, wherein the at least one calculating unit is configured to calculate the estimated transfer function based on approximately 5% of a total number of samples of each symbol.